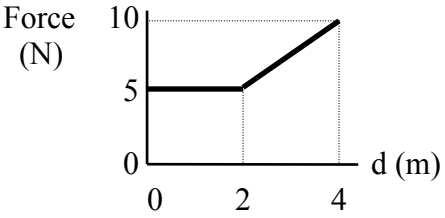
PHYSICS 12 WORK & ENERGY WORKSHEET 1

1. Find the kinetic energy of an electron when it is moving at one-tenth the speed of light.

2. Calculate the gain in kinetic energy of a cart that has an unbalanced force of 25 N acting through a distance of 6.8 m.

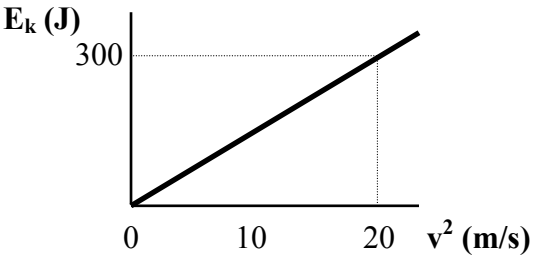
3. a) What is the kinetic energy of a mass of 10 kg moving at 5.0 m/s?
   b) If the mass were accelerated to this speed from rest by a force of 20 N, over what distance would this force act?

4. A 2.0 kg block of iron slides along a floor, decreasing its speed from 4.0 m/s to 1.0 m/s.
   a) How much work does the frictional resistance of the floor do on the block?
   b) If the reduction in velocity occurred over a distance of 10 m, what was the force of friction acting on the block?
   c) What impulse was delivered to the block?

5. 

   What is the amount of work done by the force, acting according to the graph, over the 4.0 m distance?

6. Examine the graph to the right, comparing an objects's speed with its kinetic energy.
   a) If the speed of the object represented by the graph is tripled, by what factor will the kinetic energy increase? Explain your answer.
   b) What is the mass of the object here?



7. The applied horizontal force which will just keep a 0.50 kg mass moving at a constant speed of 4.8 m/s along a rough horizontal surface is 0.30 N.
   a) What power was used to move the mass?
   b) The mass is now pulled from rest by a horizontal force of 0.80 N for 12 s What kinetic energy will it gain? Hint: first find the acceleration of the mass.
   c) Referring to (b), what power was used to accelerate the mass?

8. a) What work is done in raising a 3.0 kg mass from a 2.5 m high ledge to a 6.5 m high shelf?
   b) How much $\mathbf{E_p}$ does the mass now possess?

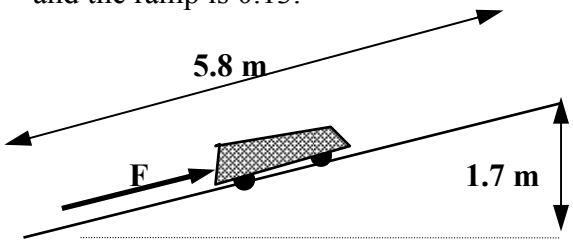
9. Describe what happens to the energy when work is done against:
   a) gravity b) inertia c) friction

10. An archer pulls the middle of his bowstring back a distance of 0.45 m. If the average force he exerts is 6.2 N, what potential energy is stored in the stretched string and bow?

11. A man pushes a 40 kg box from rest along a horizontal floor by exerting a force of 113 N horizontally. The friction force acting is 50 N. Calculate:

a) the unbalanced force.
b) the acceleration of the box.
c) the speed after 2.0 s.
d) the displacement after 2.0 s.
e) the $\mathbf{E_k}$ gained by the box in 2.0 s.
f) the energy lost as heat.
g) the total work done.
h) the total power used in 2.0 s.

12. A 45 kg cart is pushed up a ramp a length of 5.8 m from rest, attaining a speed of 2.6 m/s at the top of the ramp, which is 1.7 m high. The coefficient of friction between the cart and the ramp is 0.13.



a) Determine the work done against:
i) gravity. ii) inertia. iii) friction.

b) What force was used to push the cart?

c) What power was used to move the cart?
Hint: how long did this work take?

13. Solve for **12(b)** in the previous question by finding the acceleration and using a free-body diagram to analyze forces acting on the cart.

14. A 180 kg crate is lifted 23.0 m vertically by a single cable, accelerating upward at a rate of 1.47 m/s^2, starting from rest. Determine the following:
a) the tension in the cable.
b) the total work done on the crate. (Hint: what is the applied force here?)
c) the work done against inertia.
d) the final speed of the crate.

1. 4.1×10^{-16} J 2. 170 J 3. a) 125 J b) 6.25 m 4. a) 15 J b) 1.5 N c) 6.0 Ns 5. 25 J 6. a) 9x; $E_k \alpha v^2$ b) 30 kg
7. a) 1.4 W b) 36 J c) 3.0 W 8. a) 120 J b) 190 J 9. converts to: a) E_p b) E_k c) heat 10. 2.8 J
11. a) 63 N b) 1.6 m/s^2 c) 3.2 m/s d) 3.2 m e) 200 J f) 160 J g) 360 J h) 180 W
12. a) i) 750 J ii) 150 J iii) 320 J b) 210 N c) 271 J 13. 210 N
14. a) 2.03×10^3 N b) 4.67×10^4 J c) 6.09×10^3 J d) 8.22 m/s